

**WHAT IS CLAIMED:**

1. A method of recovering a target entity from a polydisperse liquid,  
said method comprising:
  - 5       subjecting the polydisperse liquid to a microfiltration process utilizing a  
microfiltration membrane under conditions effective to permit the target entity to pass  
through the microfiltration membrane and  
          subjecting the microfiltered polydisperse liquid to an ultrafiltration process  
utilizing an ultrafiltration membrane under conditions effective to permit the target  
10      entity to be retained on the ultrafiltration membrane, whereby the target entity is  
recovered from the polydisperse liquid in a yield of greater than 75% and a purity of  
greater than 80%.
2. The method of claim 1, wherein the microfiltration process is carried  
15      out using flow around a curved microporous walled membrane channel.
3. The method of claim 3, wherein the microfiltration process is carried  
out in a helical hollow fiber membrane module which produces Dean vortices of  
sufficient strength to disturb build-up of solute and particles near a surface of the  
20      membrane.
4. The method of claim 1, wherein the microfiltration process is carried  
out using co-flow of permeate and retentate.
- 25      5. The method of claim 1, wherein the microfiltration process is carried  
out at the target entity's isoelectric pH.
6. The method of claim 1, wherein the microfiltration process is carried  
out at a transmembrane pressure difference of less than 2 psi.
- 30      7. The method of claim 1, wherein the microfiltration process is carried  
out at an axial flow rate of less than 1 meter/second.

8. The method of claim 1, wherein the microfiltration process is carried out at a permeation flux of less than 30 lmh.

5 9. The method of claim 1, wherein the microfiltration process is carried out using a Dean vortex in a helical hollow fiber membrane module, co-flow of permeate and retentate, the target entity's isoelectric pH, a transmembrane pressure difference of less than 2 psi, an axial flow rate of less than 1 meter/second, and a permeation flux of less than 30 lmh.

10

10. The process of claim 1, wherein the microfiltration process is carried out using the target entity's isoelectric pH, a transmembrane pressure difference of less than 2 psi, an axial flow rate of less than 1 meter/second, and a permeation flux of less than 30 lmh.

15

11. The method of claim 1, wherein the target entity is selected from the group consisting of a protein, polypeptide, amino acid, colloid, mycoplasma, endotoxin, virus, carbohydrate, RNA, DNA, and antibody.

20 12. The method of claim 11, wherein the target entity is an antibody.

13. The method of claim 11, wherein the target entity is protein or polypeptide.

25 14. The method of claim 13, wherein protein or polypeptide is selected from the group consisting of glycoprotein, immunoglobulin, hormone, enzyme, serum protein, milk protein, cellular protein, and soluble receptor.

30 15. The method of claim 13, wherein protein or polypeptide is selected from the group consisting of alpha-proteinase inhibitor, alkaline phosphatase, angiogenin, antithrombin III, chitinase, extracellular superoxide dismutase, Factor VIII, Factor IX, Factor X, fibrinogen, glucocerebrosidase, glutamate decarboxylase,

human serum albumin, insulin, myelin basic protein, lactoferrin, lactoglobulin, lysozyme, lactalbumin, proinsulin, soluble CD4, components or complexes of soluble CD4, and tissue plasminogen activator.

5           16.     The method of claim 1, wherein the polydisperse liquid is milk produced by a transgenic animal.

          17.     The method of claim 16, wherein the transgenic animal is selected from the group consisting of a cow, goat, pig, rabbit, mouse, rat, and sheep.

10

          18.     The method of claim 1, wherein the polydisperse liquid is cell culture fluid from transgenic plant cells.

          19.     The method of claim 18, wherein the transgenic plant cells are from  
15 plants selected from the group consisting of alfalfa, canola, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, cauliflower, broccoli, turnip, radish, spinach, onion, garlic, eggplant, pepper, celery carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon, strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum,  
20 sugarcane, and banana.

          20.     The method of claim 1 further comprising:  
          subjecting the microfiltration membrane to an acid-free cleaning regime after  
said subjecting the polydisperse liquid to a microfiltration process.

25

          21.     The method of claim 1, wherein the ultrafiltration process is carried out by utilizing an ultrafiltration membrane under conditions effective to permit the target entity to be retained on the ultrafiltration membrane at a pH which differs from the target entity's pI.

30

          22.     The method of claim 1, wherein the ultrafiltration process is carried out at a pH above that at which the target entity precipitates.

23. The method of claim 22, wherein the ultrafiltration process is carried out at a pH greater than 8.5.

5           24. The method of claim 22, wherein the ultrafiltration process is carried out at a pH greater than 10.

25. The method of claim 1, wherein the ultrafiltration process is carried out at an ionic strength of 10-20 mM NaCl.

10

26. The method of claim 25, wherein the ultrafiltration process is carried out at an ionic strength of 12-17 mM NaCl.

27. The method of claim 1, wherein the ultrafiltration process is carried  
15 out at a permeation flux of 100-130 l/mh.

28. A method of recovering a target entity from a polydisperse liquid, said method comprising:

20           subjecting the polydisperse liquid to a microfiltration process utilizing a microfiltration membrane under conditions effective to permit the target entity to pass through the microfiltration membrane as a permeate, whereby the target entity in the permeate is greater than 90% of the target entity present in the polydisperse liquid and the target entity is present in the permeate in a concentration of 7-20%.

25           29. The method of claim 28, wherein the microfiltration process is carried out using flow around a carved microporous walled channel membrane.

30           30. The method of claim 29, wherein the microfiltration process is carried out in a helical hollow fiber membrane module which produces Dean vortices of sufficient strength to disturb build-up of solute and particles near a surface of the membrane.

31. The method of claim 28, wherein the microfiltration process is carried out using co-flow of permeate and retentate.

32. The method of claim 28, wherein the microfiltration process is carried out at the target entity's isoelectric pH.

33. The method of claim 28, wherein the microfiltration process is carried out at a transmembrane pressure difference of less than 2 psi.

34. The method of claim 28, wherein the microfiltration process is carried out at an axial flow rate of less than 1 meter/second.

35. The method of claim 28, wherein the microfiltration process is carried out at a permeation flux of less than 30 lmh.

36. The method of claim 28, wherein the microfiltration process is carried out using a Dean vortex in a helical hollow fiber membrane module, co-flow of permeate and retentate, the target entity's isoelectric pH, a transmembrane pressure difference of less than 2 psi, an axial flow rate of less than 1 meter/second, and a permeation flux of less than 30 lmh.

37. The process of claim 28, wherein the microfiltration process is carried out using the target entity's isoelectric pH, a transmembrane pressure difference of less than 2 psi, an axial flow rate of less than 1 meter/second, and a permeation flux of less than 30 lmh.

38. The method of claim 28, wherein the target entity is selected from the group consisting of a protein, polypeptide, amino acid, colloid, mycoplasma, endotoxin, virus, carbohydrate, RNA, DNA, and antibody.

39. The method of claim 38, wherein the target entity is an antibody.

40. The method of claim 38, wherein the target entity is protein or polypeptide.

41. The method of claim 40, wherein protein or polypeptide is selected  
5 from the group consisting of glycoprotein, immunoglobulin, hormone, enzyme, serum protein, milk protein, cellular protein, and soluble receptor.

42. The method of claim 40, wherein protein or polypeptide is selected  
10 from the group consisting of alpha-proteinase inhibitor, alkaline phosphatase, angiogenin, antithrombin III, chitinase, extracellular superoxide dismutase, Factor VIII, Factor IX, Factor X, fibrinogen, glucocerebrosidase, glutamate decarboxylase, human serum albumin, insulin, myelin basic protein, lactoferrin, lactoglobulin, lysozyme, lactalbumin, proinsulin, soluble CD4, component and complex of soluble CD4, and tissue plasminogen activator.

15

43. The method of claim 28, wherein the polydisperse liquid is milk produced by a transgenic animal.

44. The method of claim 43, wherein the transgenic animal is selected  
20 from the group consisting of a cow, goat, pig, rabbit, mouse, rat, and sheep.

45. The method of claim 28, wherein the polydisperse liquid is cell culture fluid from transgenic plant cells.

25 46. The method of claim 45, wherein the transgenic plant cells are from plants selected from the group consisting of alfalfa, canola, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, cauliflower, broccoli, turnip, radish, spinach, onion, garlic, eggplant, pepper, celery carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon,  
30 strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, sugarcane, and banana.

47. The method of claim 28 further comprising:

subjecting the microfiltration membrane to an acid-free cleaning regime after said subjecting the polydisperse liquid to a microfiltration process.

5           48. A method of recovering a target entity from a polydisperse liquid, said method comprising:

          subjecting the polydisperse liquid to an ultrafiltration process utilizing an ultrafiltration membrane under conditions effective to permit the target entity to be retained on the ultrafiltration membrane at a pH which differs from the target entity's  
10   pI.

          49. The method of claim 48, wherein the ultrafiltration process is carried out at a pH above that at which the target entity precipitates.

15           50. The method of claim 49, wherein the ultrafiltration process is carried out at a pH greater than 8.5.

          51. The method of claim 50, wherein the ultrafiltration process is carried out at a pH greater than 10.  
20

          52. The method of claim 48, wherein the ultrafiltration process is carried out at an ionic strength of 10-20 mM NaCl.

          53. The method of claim 48, wherein the ultrafiltration process is carried  
25 out at a permeation flux of 100-130 l/mh.

          54. The method of claim 48, wherein the target entity is selected from the group consisting of a protein, polypeptide, amino acid, colloid, mycoplasma, endotoxin, virus, carbohydrate, RNA, DNA, and antibody.  
30

          55. The method of claim 54, wherein the target entity is an antibody.

56. The method of claim 54, wherein the target entity is protein or polypeptide.

57. The method of claim 56, wherein protein or polypeptide is selected  
5 from the group consisting of glycoprotein, immunoglobulin, hormone, enzyme, serum protein, milk protein, cellular protein, and soluble receptor.

58. The method of claim 56, wherein protein or polypeptide is selected  
10 from the group consisting of alpha-proteinase inhibitor, alkaline phosphatase, angiogenin, antithrombin III, chitinase, extracellular superoxide dismutase, Factor VIII, Factor IX, Factor X, fibrinogen, glucocerebrosidase, glutamate decarboxylase, human serum albumin, insulin, myelin basic protein, lactoferrin, lactoglobulin, lysozyme, lactalbumin, proinsulin, soluble CD4, component and complex of soluble CD4, and tissue plasminogen activator.

15

59. The method of claim 48, wherein the polydisperse liquid is milk produced by a transgenic animal.

60. The method of claim 59, wherein the transgenic animal is selected  
20 from the group consisting of a cow, goat, pig, rabbit, mouse, rat, and sheep.

61. The method of claim 48, wherein the polydisperse liquid is cell culture fluid from transgenic plant cells.

25 62. The method of claim 61, wherein the transgenic plant cells are from plants selected from the group consisting of alfalfa, canola, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, cauliflower, broccoli, turnip, radish, spinach, onion, garlic, eggplant, pepper, celery carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon,  
30 strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, sugarcane, and banana.